



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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Decision Rationale

Total Maximum Daily Loads For Aquatic Life Use Impairment On Lewis Creek in Augusta County, Virginia

Signed

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Date: 8/2/2006



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I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies identified as impaired by a state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (MOS), that may be discharged to a water quality-limited water body.

This document will set forth the U.S. Environmental Protection Agency's (EPA) rationale for approving the TMDLs for the aquatic life use impairment on Lewis Creek. EPA's rationale is based on the determination that the TMDLs meet the following eight regulatory conditions pursuant to 40 CFR §130.

- 1) The TMDLs are designed to implement applicable water quality standards.
- 2) The TMDLs include a total allowable load as well as individual waste load allocations (WLAs) and load allocations (LAs).
- 3) The TMDLs consider the impacts of background pollutant contributions.
- 4) The TMDLs consider critical environmental conditions.
- 5) The TMDLs consider seasonal environmental variations.
- 6) The TMDLs include a MOS.
- 7) There is reasonable assurance that the TMDLs can be met.
- 8) The TMDLs have been subject to public participation.

II. Background

The Lewis Creek Watershed is located in Augusta County, Virginia. Lewis Creek is a tributary to the Middle River within the Shenandoah River Basin. The benthic impairment on Lewis Creek extends 9.5 miles from the City of Staunton to its mouth at Lewis Creek's confluence with Middle River. The 17,000-acre watershed is rural with agricultural, forested and developed lands making up 49, 28 and 17 percent of the watershed area respectively.

In response to Section 303(d) of the CWA, the Virginia Department of Environmental Quality listed Lewis Creek (VAV-B12R) on Virginia's 1996 Section 303(d) list for violations of the general standard (benthic) identified through benthic assessments. Lewis Creek remained on the Virginia's 1998, 2002 and 2004 Section 303(d) lists for this impairment. This decision rationale will address the TMDLs for the aquatic life use impairment.

To assess the biological integrity of a stream, Virginia uses EPA's Rapid Bioassessment Protocol II (RBPII) to determine status of a stream's benthic macroinvertebrate community.¹ This approach evaluates the benthic macroinvertebrate community between a monitoring site and its reference station. Measurements of the benthic community, called metrics, are used to identify differences between monitored and reference stations.² The state is currently in the process of changing this methodology to a stream condition index (SCI) approach.

As part of the RBPII approach, reference stations are established on streams which are minimally impacted by humans and have a healthy benthic community. These reference stations represent the desired community for the monitored sites. Monitored sites are evaluated as non-impaired, slightly impaired, moderately impaired, or severely impaired based on a comparison of the biological community of the reference and monitored sites. Streams that are classified as moderately (after a confirmatory assessment) or severely impaired after an RBPII evaluation are classified as impaired and are placed on the Section 303(d) list of impaired waters. Lewis Creek has consistently been assessed as having a moderately to severely impaired benthic community since 1994. Similar results are attained when evaluating the data through the SCI method. An upstream monitoring station (upstream of Staunton) from which data collection was initiated in 2004 exhibits a slight impairment or conditions which are better than the listing stations.

The RBPII analysis assesses the health of the macroinvertebrate community of a stream. The analysis will inform the biologist if the stream's benthic community is impaired. However, it will not inform the biologist as to what is necessarily causing the degradation of the benthic community. Additional analysis may be required to determine the pollutants which are causing the impairment as information can be gleaned based on the composition of the community and the condition of the habitat. TMDL development requires the identification of impairment causes and the establishment of numeric endpoints that will allow for the attainment of designated uses and water quality criteria.³

A reference watershed approach was used to determine the numeric endpoint for the sediment load to Lewis Creek while the endpoints for lead and polycyclic aromatic hydrocarbons (PAHs) were set at the threshold effect concentration (TEC) derived by MacDonald et al (2000). Numeric endpoints represent the water quality goals that are to be achieved through the implementation of the aquatic life use TMDLs; which will allow the impaired water to attain its designated use. A reference watershed approach is based on selecting a non-impaired watershed that shares similar land use, ecoregion, and geomorphological characteristics with the impaired watershed. The stream conditions and loadings in the reference stream are assumed to be the

¹Tetra Tech 2002. Total Maximum Daily Load (TMDL) Development for Blacks Run and Cooks Creek. Fairfax, Virginia.

²Ibid 1

³Ibid 1

conditions needed for the impaired stream to attain standards. The TEC is developed for the concentrations at which adverse impacts to organisms were no longer observed. Therefore, the sediment TMDL intends to replicate the loadings of the reference watershed in the impaired watershed to allow it to attain criteria. The lead and PAH TMDLs reduce the loadings to a level where adverse impacts were not evidenced.

The benthic TMDL was developed using the Generalized Watershed Loading Function model (GWLF). The GWLF model provides the ability to simulate runoff, sediment, and nutrient loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land).⁴ GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.⁵ Calculations are made for sediment based on daily water balance totals that are summed to give monthly values. A mass balance model was used to assess the lead and PAH loadings to Lewis Creek. This model used the sediment output of the GWLF model as lead and PAHs were coupled to sediment.

Local rainfall and temperature data were needed to develop the TMDL model. Weather data provides the rainfall data which drives the TMDL model. Weather data was obtained from the Staunton Sewage Treatment Plant national climatic data center (NCDC) station 448062. Stream flow data was not available from a continuous gage on Lewis Creek therefore HSPF stream flow model of Middle River was used for Lewis Creek. The model for the reference watershed (Upper Opequon Creek) used a local stream gage and the NCDC weather stations for Winchester and Berryville. The loadings for the TMDLs are provided in Table1.

Table 1 - Summarizes the Specific Elements of the TMDL.

Segment	Parameter	TMDL	WLA	LA	MOS
Lewis Creek	Lead (kg/yr)	203,570	0	203,570	Implicit
	Lead (kg/day)	557	0	557	Implicit
	PAHs (kg/yr)	7,151	0	7,151	Implicit
	PAHs (kg/day)	19	0	19	Implicit
	Sediment (Tons/yr)	3,218	40	2,857	322
	Sediment (Tons/day)	8.8	0.11	7.8	0.88

The United States Fish and Wildlife Service has been provided with a copy of these TMDLs.

⁴Ibid 1

⁵Ibid 1

III. Discussion of Regulatory Conditions

EPA finds that Virginia has provided sufficient information to meet all of the eight basic requirements for establishing the aquatic life (benthic) use impairment TMDLs for Lewis Creek. EPA is therefore approving the TMDLs. EPA's approval is outlined according to the regulatory requirements listed below.

1) The TMDLs are designed to meet the applicable water quality standards.

As stated above, the biological assessments do not necessarily discern a clear stressor to a stream. However, historical operations and past studies within the watershed documented a lead and PAHs problem. The TMDL modelers did conducted a stressor identification analysis to confirm the past findings and determine if there were any other stressors to the biological community. Water quality data was compared with state approved water quality criteria and guidance values and for parameters without criteria the data was compared with the 90th percentile values of 14 biological monitoring reference sites within the Potomac River Basin. There were no violations in the dissolved oxygen, temperature or pH criteria. Toxicity sampling revealed a higher mortality rate in Fathead Minnows reared in water obtained from Lewis Creek. PAHs were not found individually in concentrations above their applicable probable effects concentration (PEC) values. However, there were enough compounds detected that this additive effects could be causing a toxicity problem. The total PAH concentrations were above the TEC published by MacDonald in 2000. Therefore, PAHs were ruled a most probable stressor. Lead concentrations in the sediment of Lewis Creek was above both, the TEC and PEC, and therefore, ruled a most probable stressor. There are also known un-remediated lead sources within the watershed. Sediment was seen as another most probable stressor because of specific metrics within the bioassessments and size of the modeled sediment load to the watershed when compared to a reference watershed.

The GWLF model was used to determine the loading rates of sediment to the impaired and reference streams from all point and nonpoint sources. The TMDL modelers determined the sediment loading rates within each watershed. Data used in the model was obtained on a wide array of items, including land uses in the area, point sources in the watershed, weather, stream geometry, etc.. The GWLF model provides the ability to simulate runoff and sediment loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land). GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.⁶ In the GWLF model, the nonpoint source load calculation is affected by terrain conditions, such as the amount of vegetative, land slope, soil erodibility, and land practices used in the area.⁷ Parameters within the model account for these conditions and

⁶Ibid 1

⁷Ibid 1

practices. Although the GWLF model was developed for ungaged watersheds, it was calibrated to Hydrologic Simulation Program Fortran model on Middle River. A mass-balance approach was used to develop the TMDL loads for lead and PAHs. The sediment output load from the GWLF was used to determine the watershed loading and reductions were made until the loads were at or below the TEC.

2) *The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.*

Total Allowable Loads

Virginia indicates that the total allowable loading is the sum of the loads allocated to land based precipitation driven nonpoint source areas (forest and agricultural land segments) and point sources. Activities that increase the levels of lead, PAHs and sediment to the land surface or their availability to runoff are considered flux sources. The actual value for total loading can be found in Table 1 of this document. The total allowable load is calculated on an annual and daily basis.

Waste Load Allocations

There are no facilities permitted to discharge either lead or PAHs into Lewis Creek. There are fifteen facilities permitted to discharge sediment to Lewis Creek. These facilities are all under general permits and they consist of six construction sites, two single family homes, three industrial stormwater facilities, three concrete facilities and one non metallic mining operation. Table 2 documents the WLA for these facilities.

EPA regulations require that an approvable TMDL include individual WLAs for each point source. According to 40 CFR 122.44(d)(1)(vii)(B), “Effluent limits developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA pursuant to 40 CFR 130.7.” Furthermore, EPA has authority to object to the issuance of any National Pollutant Discharge Elimination System (NPDES) permit that is inconsistent with the WLAs established for that point source.

Table 2 – WLAs for Lewis Creek

Facility	Permit Number	Pollutant	WLA (Tons/yr)
Harrington Place	VAR104649	Sediment	0.08
Single Family Unit	VAG401882	Sediment	0.041
Single Family Unit	VAG401072	Sediment	0.041
Transit Mixed Concrete	VAG110071	Sediment	0.08
Augusta Blocks LLC	VAG110073	Sediment	0.13
Appomattox Lime Co-Belmont Quarry	VAG840030	Sediment	31.59
Dixie Gas and Oil Corp Bulk Plant	VAR050826	Sediment	0.11
Ord's Auto Parts	VAR051333	Sediment	2.94

Augusta Blocks LLC	VAR050779	Sediment	1.62
Project #0262-007-101, C502	VAR100570	Sediment	1.18
VDOT Verona Resid 0262-007-101,C503, B609, B614, B615	VAR103788	Sediment	1.88
	VAR101703		
Disposal Area 2 – VDOT NFO 02262 007 101 C503	VAR102097	Sediment	0.15
Triangle Residential Services Building – Staunton	VAR103916	Sediment	0.04

Load Allocations

According to Federal regulations at 40 CFR 130.2(g), LAs are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading. Wherever possible, natural and nonpoint source loads should be distinguished.

For the sediment TMDL the GWLF model was used to ascertain the sediment loading to Lewis Creek and Upper Opequon Creek the reference watershed. The model provided the monthly sediment load to the streams through the use of the universal soil loss equation (USLE). The USLE derives the sediment loading by using information on precipitation rates, best management practices, land slope, and vegetative cover. Table 3a identifies the current and TMDL loading for sediment to Lewis Creek. A mass balance equation was used for the lead and PAH TMDLs. The loads were broken down into combined background from the sub-watersheds and a combined contaminated sites load from the known non-remediated sites within the watershed. The lead and PAH loadings can be found in Tables 3b and c.

Table 3a - LA for Sediment for Lewis Creek

Source Category	Existing Load (Tons/yr)	Proposed Load (Tons/yr)
Cropland	1,059	798
Pasture	4,579	1,431
Forest	5	5
Developed Lands	332	192
Wetlands	0.3	0.3
Transitional	282	73
Staunton Metal Recyclers	0.06	0.06
Klotz Brothers Courtyard	0.05	0.05
Beverly Exxon	0.04	0.04
Columbia Gas	0.06	0.06
Streambank Erosion	445	355

Table 3b - LA for Lead for Lewis Creek

Source Category	Existing Load (kg/yr)	Proposed Load (kg/yr)
Background Sub-watershed 1	29,442	29,442
Background Sub-watershed 2	86,720	84,321

Background Sub-watershed 3	86,506	86,506
Contaminated Sites	330,203	3,302

Table 3c - LA for PAHs for Lewis Creek

Source Category	Existing Load (kg/yr)	Proposed Load (kg/yr)
Background Sub-watershed 1	769	769
Background Sub-watershed 2	5,119	4,293
Background Sub-watershed 3	1,887	1,887
Contaminated Sites	20,239	202

3) The TMDLs consider the impacts of background pollution.

The TMDL considers the impact of background pollutants by considering the sediment loadings from background sources such as forested land and calibrating the model to observed conditions.

4) The TMDLs consider critical environmental conditions.

According to EPA's regulation 40 CFR 130.7 (c)(1), TMDLs are required to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of Lewis Creek is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards⁸. Critical conditions are a combination of environmental factors (e.g., flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

The GWLF model was run over a multi-year period to insure that it accounted for a wide range of climatic conditions. The allocations developed in these TMDLs will therefore insure that the criteria are attained over a wide range of environmental conditions including wet and dry weather conditions.

⁸EPA memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Management Division Directors, August 9, 1999.

5) The TMDLs consider seasonal environmental variations.

Seasonal variations involve changes in stream flow and loadings as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flows normally occur in early spring from snow melt and spring rain, while seasonally low flows typically occur during the warmer summer and early fall drought periods. Consistent with the discussion regarding critical conditions, the GWLF model and TMDL analysis effectively considered seasonal environmental variations through the use of observed weather data over an extended period of time and seasonal vegetative growth cycles.

6) The TMDLs include a margin of safety.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. The MOS may be implicit, built into the modeling process by using conservative modeling assumptions, or explicit, taken as a percentage of the WLA, LA, or TMDL. Virginia included an implicit MOS in the lead and PAH TMDLs through the use of conservative modeling assumptions. An explicit 10 percent MOS was used for the sediment TMDL.

7) There is a reasonable assurance that the TMDLs can be met.

EPA requires that there be a reasonable assurance that the TMDLs can be implemented. WLAs will be implemented through the NPDES permit process. According to 40 CFR 122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

Nonpoint source controls to achieve LAs can be implemented through a number of existing programs such as Section 319 of the CWA, commonly referred to as the Nonpoint Source Program.

8) The TMDLs have been subject to public participation.

During the development of the TMDL for the Lewis Creek Watershed, public involvement was encouraged at the two public meetings which were held to discuss and disseminate the TMDL. A basic description of the TMDL process and the agencies involved was presented at the first public meeting on January 24, 2005 at Staunton City Hall in Staunton, Virginia with 51 people in attendance. The first technical advisory committee (TAC) meeting was held on November 30, 2005 at Staunton City Hall in Staunton, Virginia with 28 people in attendance. The second TAC and public meeting were held at the same location on January 15, 2006 and March 8, 2006 respectively. Twenty-six people attended the second (final) public meeting. The public meetings were noticed in the Virginia Register and open to a 30-day public comment period. Two sets of written comments were received which were responded to

by the state.